# CAM ACTION SHAFT LOCK DEVICE AND METHOD

## Field of the Invention

The invention disclosed herein relates generally to an addressing machine in a mass mailing system and, more particularly, to a locking mechanism for locking a print head assembly in the addressing machine

## Background of the Invention

In a mass mailing system, an addressing machine having a plurality of print heads is typically used to print a mailing address on an envelope along with other printed items, such as the postage indicia, return address and promotional messages. Because the size of the envelope may vary, the print head in the addressing machine must be adjusted. Typically, the print heads are mounted on one or more shafts so that the position of the print heads can be adjusted along the longitudinal axis of the shaft, which is substantially perpendicular to the moving direction of the envelope.

As shown in Figure 1a, the addressing machine **1** comprises an envelope feeder **10** and a printing section **100**. The envelope feeder **10** has a driving mechanism **16** for releasing one envelope **14** at a time from a stack **12** to the printing section **100**. The printing section **100** has a driving mechanism **20** and a pair of pickup rollers **24** to move the released envelope **14** further along the moving direction 90. While the envelope **14** is moving along the moving direction **90**, a plurality of print head assemblies **40** is used to print the printed items on the envelope **14**.

A top view of the printing section **100** is shown in Figure 2. As shown, the printing section **100** has a rack **200** for mounting a plurality of shaft mounts **210**. The print head assemblies are mounted on a plurality of shafts **220**, which are mounted on the shaft mounts **210**. In order to adjust the print head assemblies **40** relative to the moving path **92** of the envelope **14**, the print head assemblies **40** can be slid on the shafts **220**. Once each of the print head assemblies **40** has been moved to a desired position, it is locked in

that position so that the printed items on the envelope **14** can be printed in a designated area in a consistent fashion. Advantageously, the print head assembly **40** comprises a plurality of print heads fixedly mounted on a carriage **50**, which is slideably mounted on the shaft **220**.

Furthermore, a machine operator should be able to rotate the print head assemblies 40 upward, as shown in Figure 3, to occasionally clean the print heads on the assemblies.

Thus, it is desirable and advantageous to provide a method and device for locking and unlocking the print head assemblies so that the position of the print head assemblies relative to the moving path of the envelope can be easily changed or adjusted. Furthermore, it is desirable and advantageous to have a reasonably small locking mechanism so that it will not interfere with the operator when the operator adjusts the position of the print head assemblies and when the operator lifts the print head assemblies for cleaning or other maintenance purposes.

## Summary of the Invention

The present invention provides a method and mechanism for locking and unlocking a device for engaging connecting a carriage to a shaft, such that when the device is unlocked, the carriage position along the shaft can be adjusted, and when the device is locked, the adjusted position is maintained. This objective can be achieved by using a cylindrical body slideably mounted on the shaft, and a cam ring rotatably mounted over the cylindrical body. The shaft has a slot for seating a spline, and the inner circumference of the cam ring presses the spline against the shaft for locking the cylindrical body against the shaft. The inner circumference has a relief such that, when the cam ring is rotated to the unlocked position, the spline is partially seated in the relief, thereby reducing the pressure exerted by the spline against the shaft.

Thus, according to the first aspect of the present invention, there is provided a locking device for use in conjunction with a shaft for engagingly connected to a carriage, the shaft having a longitudinal axis. The locking device comprises:

a cylindrical body slideably mounted on the shaft, the cylindrical body having an inner circumference, an outer circumference, a thickness defined by the inner and outer circumferences, and an aperture opened through the thickness of the cylindrical body, wherein the cylindrical body further has a mounting mechanism for engagingly attaching the carriage;

an elastomer body, seated in the aperture, for providing a frictional force against the shaft when the elastomer body is pressed toward the shaft; and

a cam ring having an inner surface mounted over the outer circumference of the cylindrical body for rotational movement about a rotation axis between a first position and a second position, the rotational axis substantially parallel to the longitudinal axis of the shaft, the cam ring having a clearance on the inner surface, wherein

when the cam ring is located at the first position, the clearance is spaced from the aperture, and the inner surface of the cam ring presses the elastomer body toward the shaft, providing a frictional force against shaft, thereby restricting the cylindrical body from moving along the longitudinal axis, and

when the cam ring is located at the second position, the clearance is aligned with the aperture on the cylindrical body, allowing the elastomer body to seat partially in the clearance, thereby reducing the frictional force against the shaft such that the cylinder body can be moved along the longitudinal axis for adjusting the position of carriage along the shaft.

Preferably, the cylindrical body has a coaxially extended section, the extended section having an outer circumference, and wherein the carriage has a flange, the flange having an opening for mounting over the outer circumference of the extended section.

Preferably, the flange has a tab protruding into the opening of the flange, and wherein the extended section has a slot cutting into the out circumference of the extended section for seating the tab so as to prevent the flange from rotating relative to the extended section.

Preferably, the extended section has a threaded segment, the locking device further comprising a lock nut for engaging with threaded section in order to keep the flange fixedly mounted on the extended section.

Preferably, the flange is mounted on the extended section between the lock nut and the cam ring.

Preferably, the cam ring has a further clearance which is shallower than the clearance such that when the cam ring is located at second position, the elastomer body is partially seated in the further clearance but substantially maintaining the frictional force against the shaft for restricting the cylindrical body from moving along the longitudinal axis.

According to the second aspect of the present invention, there is provided a method for locking and unlocking a carriage engagingly connected to a shaft having a longitudinal axis. The method comprises the steps of:

1) providing a locking device, slideably mounted on the shaft, for securely attaching the carriage, the locking device comprising:

a cylindrical body, having an inner circumference adjacent the shaft, an outer circumference, a thickness defined by the inner and outer circumferences, and an aperture opened through the thickness of the cylindrical body;

an elastomer body, seated in the aperture, for providing a frictional force against the shaft when the elastomer body is pressed toward the shaft;

a cam ring having an inner surface mounted over the outer circumference of the cylindrical body for rotational movement about a rotational axis, between a first position and a second position, the rotational axis substantially parallel to the longitudinal axis of the shaft, the cam ring having a clearance on the inner surface, such that when the cam ring is located at the first position, the clearance is spaced from the aperture, causing the inner surface to press the elastomer body toward the shaft, thereby providing a frictional force against the shaft, and when the cam ring is located a the second position, the clearance is aligned with the aperture of the cylindrical body, allowing the elastomer body to seat partially in the clearance, thereby reducing the frictional force against the shaft;

2) rotating the cam ring to the second position to reduce the friction force against the shaft, so as to adjusting the position of the carriage along the shaft; and

3) rotating the cam ring to the first position so as to provide a frictional force against the shaft, thereby maintaining the adjusted position of the carriage.

Reversing the cam ring reverses the locking direction from counter clockwise to clockwise or visa versa.

According to the third aspect of the present invention, there is provided an addressing machine having at least one print head assembly for printing a substantially flat item moving a moving direction, the flat item has a size, the addressing machine comprising:

at least one shaft having a longitudinal axis, substantially perpendicular to the moving direction of the flat item;

a shaft mount for mounting the shaft; and

a locking device comprising:

a cylindrical body slideably mounted on the shaft, the cylindrical body having an inner circumference, an outer circumference, a thickness defined by the inner and outer circumferences, and an aperture opened through the thickness of the cylindrical body, wherein the cylindrical body further has a mounting mechanism for engagingly attaching the print head assembly;

an elastomer body, seated in the aperture, for providing a frictional force against the shaft when the elastomer body is pressed toward the shaft; and

a cam ring having an inner surface mounted over the outer circumference of the cylindrical body for rotational movement about a rotation axis between a first position and a second position, the rotational axis substantially parallel to the longitudinal axis of the shaft, the cam ring having a clearance on the inner surface, wherein

when the cam ring is located at the first position, the clearance is spaced from the aperture, and the inner surface of the cam ring presses the elastomer body toward the shaft, providing a frictional force against shaft, thereby restricting the cylindrical body from moving along the longitudinal axis, and

when the cam ring is located at the second position, the clearance is aligned with the aperture on the cylindrical body, allowing the elastomer body to seat partially in the clearance, thereby reducing the frictional force against the shaft such that the cylinder body can be moved along the longitudinal axis for adjusting the position of carriage along the shaft relative to the moving direction, based on the size of the flat item.

The flat item can be an envelope, a sheet of paper or a mailpiece.

The present invention will become apparent upon reading the description taken in conjunction with Figure 1 to 14.

## Description of the Drawings

The above and other objects and advantages of the present invention will be apparent upon consideration of the following detailed description, taken in conjunction with accompanying drawings, in which like reference characters refer to like parts throughout, and in which:

Fig. 1 is ; a schematic representation showing an addressing machine having a plurality of print head assemblies to print printed items on an envelope.

Fig. 2 is ; a schematic representation showing the top view of the printing section of the addressing machine.

Fig. 3 is ; a schematic representation showing the print head assemblies are lifted upward for maintenance purposes.

Fig. 4 is ; an exploded view showing the locking device and part of the print head assembly relative to the shaft, according to present invention.

Fig. 5 is ; a top view showing the locking device and part of the print head assembly, wherein the locking device is operated in a first position.

Fig. 6 is ; a top view showing the locking device and part of the print head assembly, wherein the locking device is operated in a second position.

Fig. 5 is ; a cross sectional view showing a lock nut.

Fig. 8a is ;a top view of the locking body, according to the present invention.

Fig. 8b is ;a bottom view showing the locking body of Figure 8a.

Fig. 9 is ; a cross sectional view of the carriage flange.

Fig. 10 is ;a cross sectional view of the threaded section of the locking body.

Fig. 11 is ; a cross sectional view showing the lock section of the locking body and a spline.

Fig. 12 is ;a cross sectional view of the cam ring, according to the present invention.

Fig. 13 is ; a cross sectional view showing the cam ring operated in the unlocked position.

Fig. 14 is ; a cross sectional view showing the cam ring operated in the locked position.

## Detailed Description of the Present Invention

In describing the present invention, reference is made to the drawings, wherein there is seen in Figs. 4 shows an exploded view of the locking device **300** and part of a carriage arm **250**. The carriage arm **250** is part of the carriage **50** for mounting the print heads in the print head assembly **40** (see Figure 2). The carriage arm **250** has a carriage flange **252** to be mounted on the locking device **300**. As shown in the figure, the locking device **300** comprises a locking body **310**, a cam ring **360**, a lock nut **380**, and an elongated spline **370** (see Figures 11, 13, 14). The locking body **310** is basically a cylindrical body having an inner diameter slightly larger than the outer diameter of the shaft **220**, so that when the locking device **300** is not operated in a locked position, the locking body **310** can be moved from one part of the shaft to another in order to adjust the position of the print head assembly **40**. The locking body **310** has a threaded section **320** joining a lock section **330**, and a flange **350** at the end of the lock section **330**, as shown in Figures 8a and 8b.

Figure 5 is a top view showing all the components in the locking body **310** are assembled to engagingly attach the carriage flange **252**. As can be seen in Figures 12 to 14, the cam ring **360** has an inner diameter slightly larger than the outer diameter of the lock section **330** so as to allow the cam ring to rotate relative to the lock section about the longitudinal axis **222**. The outer diameter of the flange **350** is larger than the inner diameter of the cam ring **360** in order to retain the cam ring **360**. The carriage flange **252** has a circular opening **254**, the diameter of the circular opening **254** is slightly larger than the outer diameter of the threaded section **320** of the locking body **310**, so that the carriage flange **252** can be slipped through the threaded section **320** up to the lock section **330**. As can be seen in Figures 8a, 9 and 10, the threaded section **320** has an anti-rotation slot **326**, and the carriage flange **252** has a tab **256**, protruding into the inner

surface of the circular opening **254**. When the carriage flange **252** is slipped through the threaded section **320**, the tab **256** is fittingly seated in the anti-rotation slot **326**, such that the carried flange **252** cannot be rotated about the longitudinal axis **222** of the shaft **220** relative to locking body **310**. As such, when the cam ring **360** is rotated about the longitudinal axis **222** relative to the locking body **310**, it does not cause the carriage flange **252** to rotate. Finally, a lock nut **380** is used to keep all the components together as the components are assembled. The lock nut **380** is shown in Figure 7.

As shown in Figures 5 and 6, the cam ring **360** has a lever **352**, so as to allow an operator to rotate the cam ring **360** from one position to another in order to lock and unlock the locking body **310** relative to the longitudinal axis **222** of the shaft **220**.

Figure 8a is a top view of the locking body **310**. As shown, the anti-rotation slot **324** is an elongated slot, communicating the length of the threaded section **320**. Figure 8b is a bottom view of the locking body **310**. A shown in the figure, the lock section **330** of the locking body **310** has an elongated aperture or through-slot **334**. The slot **334** is also shown the cross sectional view of the lock section **330**, as shown in Figure 11. The slot **334** is used to seat a spline **370**, which is made of a high friction material, a durable elastomer such as urethane, for locking purposes.

To facilitate the locking and unlocking function of the locking body **310**, an elongated relief **364** is provided on the inner surface of the cam ring **360**, as shown in Figure 12. When the cam ring **360** is rotated to a position such that the elongated relief **364** is substantially aligned with the slot **334** in the threaded section **320**, the spline **370** can partially move into the relief **364**, as shown in Figure 13. As such, the spline **370** does not exert pressure on **220**, allowing the locking body **310** to be moved from one part of the shaft **220** to another part of the shaft **220** along the longitudinal axis **222**.

When the cam ring **360** is rotated to another position such that the elongated relief **364** is no longer aligned with the slot **334**, the spline **370** is pushed toward the shaft **220** through the slot **334** by the inner surface of the cam ring **360**. As such, a strong pressure exerted against the shaft **220** by the spline **370**. The high friction between the spline 370 and the shaft **220** prevents the locking body **310** from sliding.

With the locking body **310** of the present invention, the operator can use the lever **352** to rotate the cam ring **360** relative to the locking body **310** to release the pressure

exerted on the shaft **220** by the spline **370** and then adjust the position of the print head assembly **40** fixedly mounted on the carriage **50** (see Figure 2). When the print head assembly **40** is located at a desired position, the operator can use the lever **352** to rotate the cam ring **360** for moving the relief **364** away from the slot **334**, thereby locking the print head assembly **40** relative to the moving path **92** of the envelope **14** (see Figure 2).

Advantageously, a minor relief **366** is also provided on the inner surface of the circular opening **360**. As such, when the operator rotates the cam ring **360** from the unlocked position as shown in Figure 13 to a new position as shown in Figure 14, the operator can feel that the locked position has been reached.

The shaft **220** can be rotatably mounted on the shaft mount **210** (see Figure 2), as such, the operator can lift the print head assembly **40** along with the locking body **310**, without moving any part of the locking body **310**.

As shown in Figures 13 and 14, the cam ring **360** is rotated in a counter-clockwise direction from the unlocked position to the locked position. It should be noted that the cam ring **360** has two ends. Either end can be located adjacent to the flange **350**. Thus, the cam ring **360** can be installed differently so that it is rotated in a clockwise direction from the unlocked position to the locked position. Furthermore, the lever **352** can be disposed at any desired location on the outer diameter of the cam ring **330**, depending on how the print head assembly is mounted on the shaft.

Thus, although the invention has been described with respect to a preferred embodiment thereof, it will be understood by those skilled in the art that the foregoing and various other changes, omissions and deviations in the form and detail thereof may be made without departing from the scope of this invention.

While the present invention has been disclosed and described with reference to a single embodiment thereof, it will be apparent, as noted above that variations and modifications may be made therein. It is also noted that the present invention is independent of the machine being controlled, and is not limited to the control of inserting machines. It is, thus, intended in the following claims to cover each variation and modification that falls within the true spirit and scope of the present invention.